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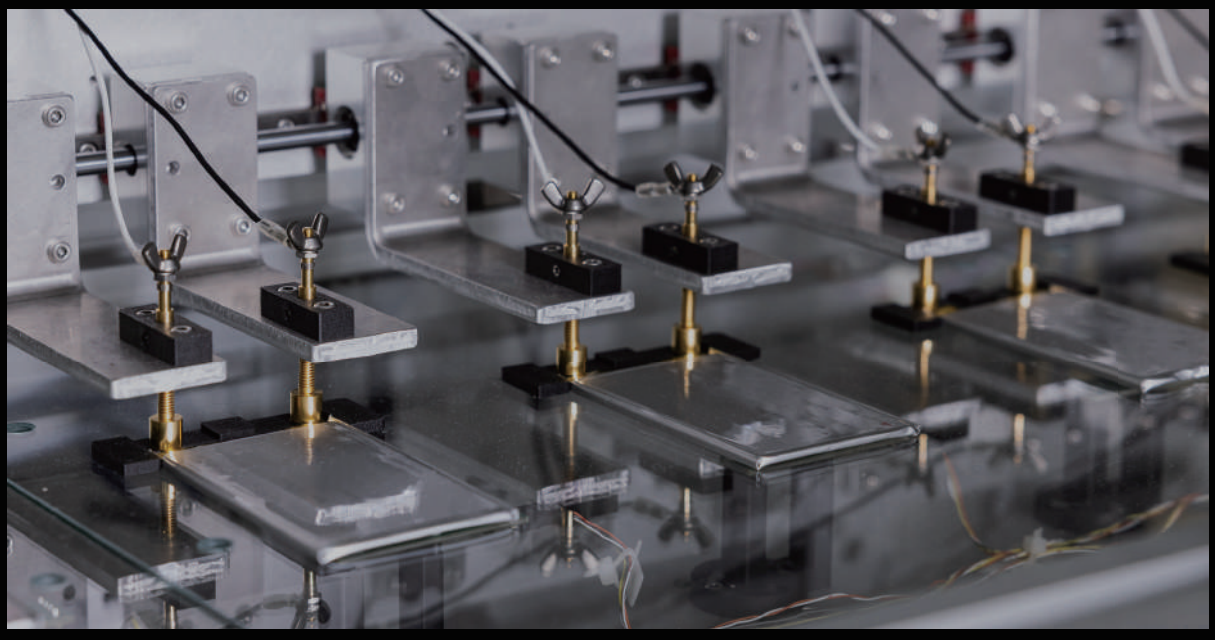
CATALOG

Nondestructive Rechargeable Battery Inspection Systems

The world's first technology for nondestructive analysis of rechargeable battery failures



Solving critical issues by visualization technology

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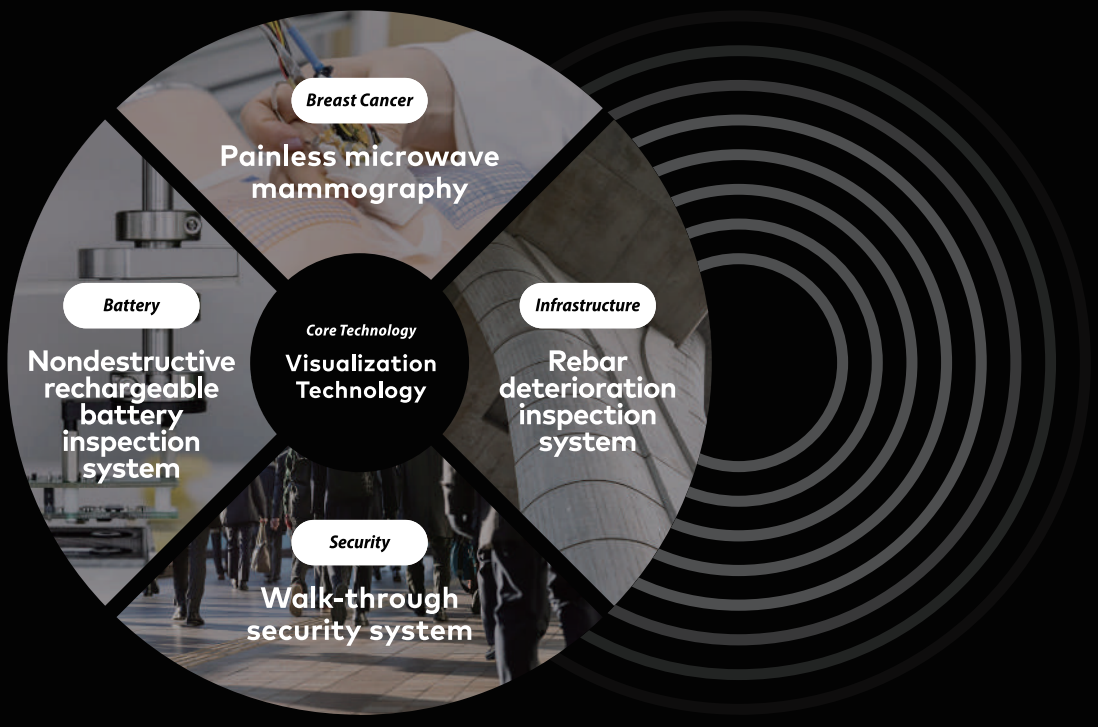
About IGS

IGS is a Deep Tech company that makes the invisible visible to solve human problems.

At IGS, we specialize in solving complex challenges through groundbreaking deep-tech solutions. Our advanced imaging technologies allow us to visualize the unseen, bringing clarity across key industries such as healthcare, energy, and infrastructure.

With a dedicated R&D base at the Kobe University Incubation Center, we are committed to developing and commercializing technologies that will shape a safer, more efficient world.



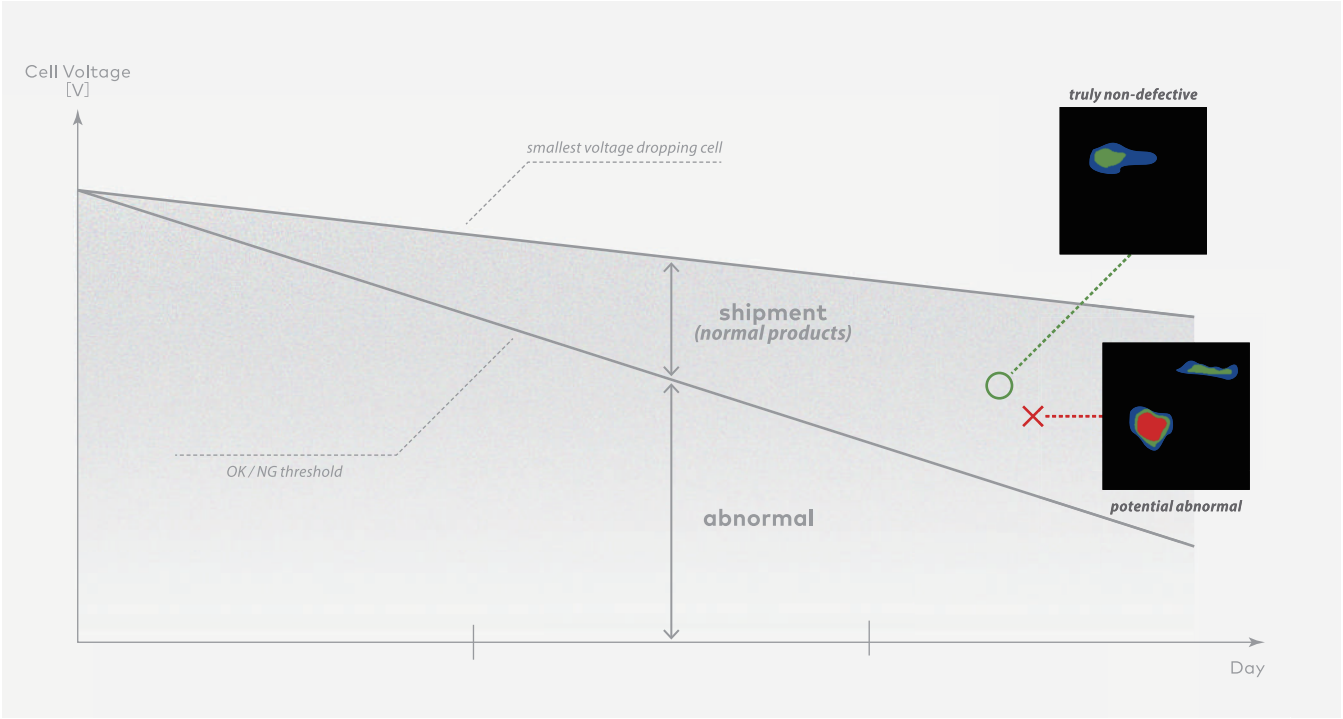
Issues with conventional battery inspection methods

Rising Demand for Lithium-Ion Batteries: Addressing Safety Risks

Amid growing concerns over the safety of lithium-ion batteries, widely used in popular consumer products such as electric vehicles (EVs) and smartphones, a rise in fire and explosion incidents has highlighted the need for more reliable inspection technologies.

Defective Products in Shipments: The Need for Improved Battery Inspection Accuracy

Battery manufacturers currently employ "aging tests" to detect defective batteries that experience a sudden voltage drop when charged. However, these conventional methods often fail to identify latent defects, which have led to accidents involving exploding batteries despite passing inspections.
To truly prevent fire risks and ensure battery safety, a more accurate, advanced inspection method is essential.



Features

1 Direct Assessment of Electric Current-Density Distribution Inside Batteries

Our system can directly measure the electric current-density distribution within a battery, which is crucial for its operation and longevity. This capability allows us to accurately identify the root cause of any failures, enhancing both diagnostic precision and battery reliability.

2 Nondestructive Inspection of Battery Internal Current

Our technology allows for the assessment of the internal electric current status without damaging the battery, ensuring that it continues to operate with the same quality and performance as it had before testing.

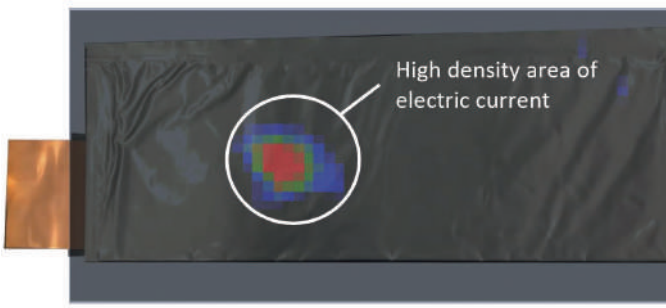
3 Detection of Minute Short Circuits in Shipped Batteries

Our technology can identify minor short circuits in batteries that have already been deemed functional. This capability allows us to detect slight spatial irregularities in electric current density, even before a short circuit occurs, ensuring optimal battery performance and reliability.

Inspection Method

The nondestructive storage battery imaging diagnostic system automatically measures the battery's magnetic field, calculating electric current distributions using software based on inverse analysis theory

The data is visualized, highlighting areas with irregular electric concentration in different colors, enabling easy identification of potential faults.



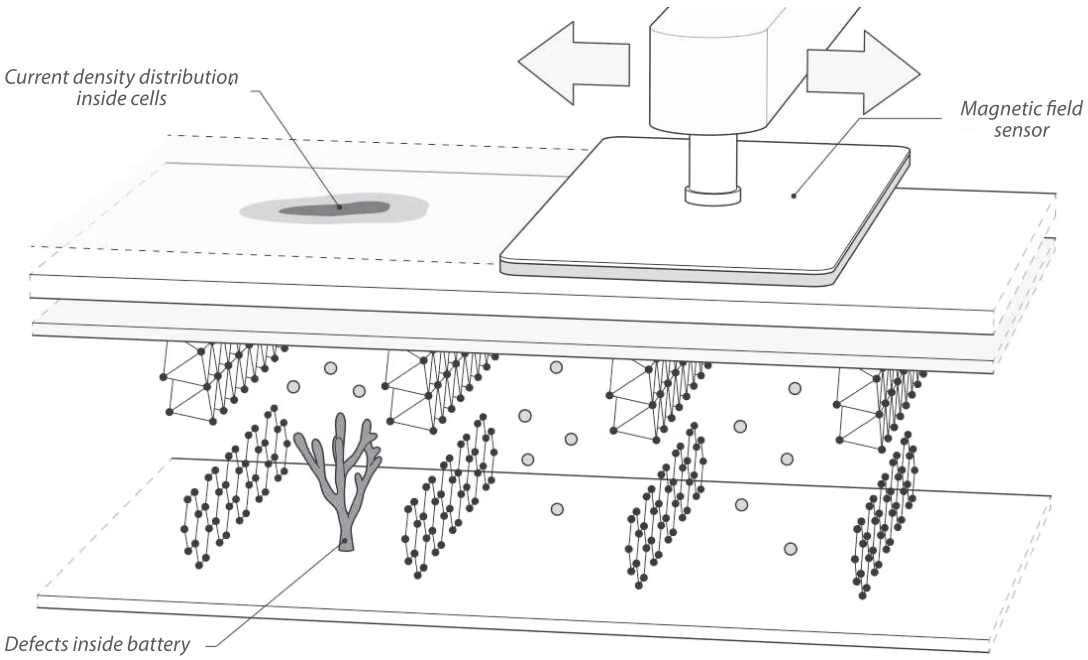
Areas in which there is an irregular concentration of electricity are displayed in a different color

Technology

Using a proprietary calculation theory, IGS visualizes density distribution and short-circuit locations within storage batteries

Our nondestructive imaging diagnostic system measures the magnetic field generated by electric current using an ultra-sensitive magnetic sensor, identifying potential failure points.

Since the system applies only alternating current, evaluations are performed without damaging the battery.



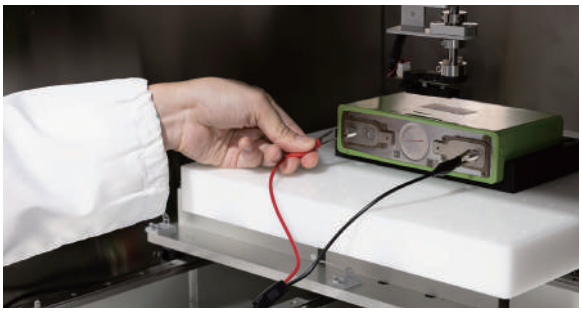
Inspection Process

Seamlessly Visualizing the Invisible

STEP 1

Applying Current to the Battery

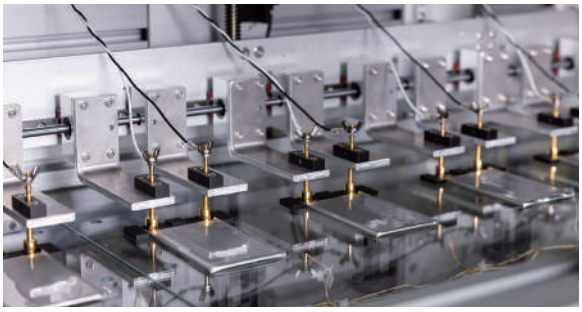
An alternating current is applied to the battery for diagnostic analysis.



STEP 2

Measure Magnetic Fields

The magnetic field generated by the current is measured using an ultra-sensitive magnetic field detector.



STEP 3

Deriving Internal Current Density Distribution

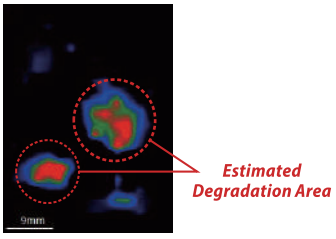
Using the world' s first inverse analysis theory, the magnetic field data is used to instantly reconstruct the current density distribution inside the battery.

$$H_i(x,y,z)=\frac{1}{(2\pi)^2}\iint e^{(ik_x x+ik_y y)}\left\{\frac{1}{2}\left[f(k_x,k_y)+\frac{g(k_x,k_y)}{\sqrt{k_x^2+k_y^2}}\right]e^{z\sqrt{k_x^2+k_y^2}}+\frac{1}{2}\left[f(k_x,k_y)-\frac{g(k_x,k_y)}{\sqrt{k_x^2+k_y^2}}\right]e^{-z\sqrt{k_x^2+k_y^2}}\right\}dk_x dk_y$$

STEP 4

Image Processing and Diagnosis

Our imaging diagnostic system processes the data to highlight potential areas of concern, ensuring early detection of issues that could lead to battery failure.



User benefits

Why Choose IGS Technology?

■ High-Precision Inspection

Our technology offers extremely high inspection precision, making it possible to visualize power generation inconsistencies and predict fire risks—issues that traditional methods cannot detect.

■ Full 100% Inspection to Prevent Shipping of Defective Products

By implementing this technology, full inspections at the point of shipment, ensuring that no defective products leave, allowing inspection of up to 100,000 cells per day.

■ Scalable to Both R&D and Mass Production

Our system supports failure analysis, sample testing, and full in-line inspection. It is customizable to meet various measurement needs, making it ideal for battery abnormality analysis and quality control.

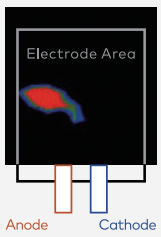
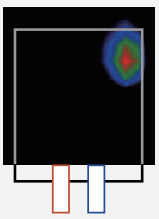
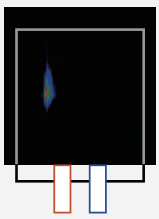
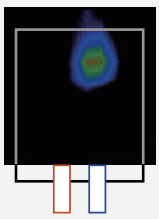
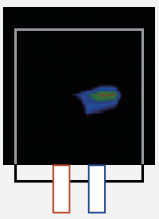
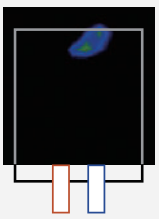
Comparison with Common Inspection Technologies

Method	Our System	X-ray	Voltage Testing	Lock-in Infrared Thermography
Internal Observation	○ *Can observe spatial distribution of power generation*	△ *Enables high-resolution observation of mechanical structures*	× *Cannot observe internally*	× *Only excessive defects can be observed*
Product Evaluation Capabilities	○ *Non-uniformities / short circuit locations / inconsistencies in quality, etc.*	△ *Can detect visible internal foreign objects and deformation*	× *Estimates battery anomalies via self-discharge measurement*	× *Can only detect surface short circuits in storage batteries*
Implementation Costs	○ *Approximately ¥10~100M*	× *Requires X-ray handling facilities/equipment in addition to the device*	× *Requires storage space for self-discharge measurement*	× *Equipment: Approximately ¥10~¥100M+*

Evaluation Example of Lithium-Ion Batteries

In our system, the red areas on the image represent regions with high current density—indicating a higher risk of fire or degradation. Even if aging tests and self-discharge measurements are similar, a larger red area suggests faster degradation during repeated cycles.

Our system not only detects high-risk areas within lithium-ion cells but also provides a grading system based on quality and projected lifespan. This allows for more informed decision-making and proactive battery management.

	CELL❶	CELL❷	CELL❸	CELL❹	CELL❺	CELL❻
Self-discharge Rate *(from aging tests)*	~0.1mV / day					
Measure-ment Results						
Defect Severity Index *(IGS original metric)*	5.43	4.00	3.95	3.70	3.70	3.59
Cycle life	69	83	91	119	120	186

Latent defects※

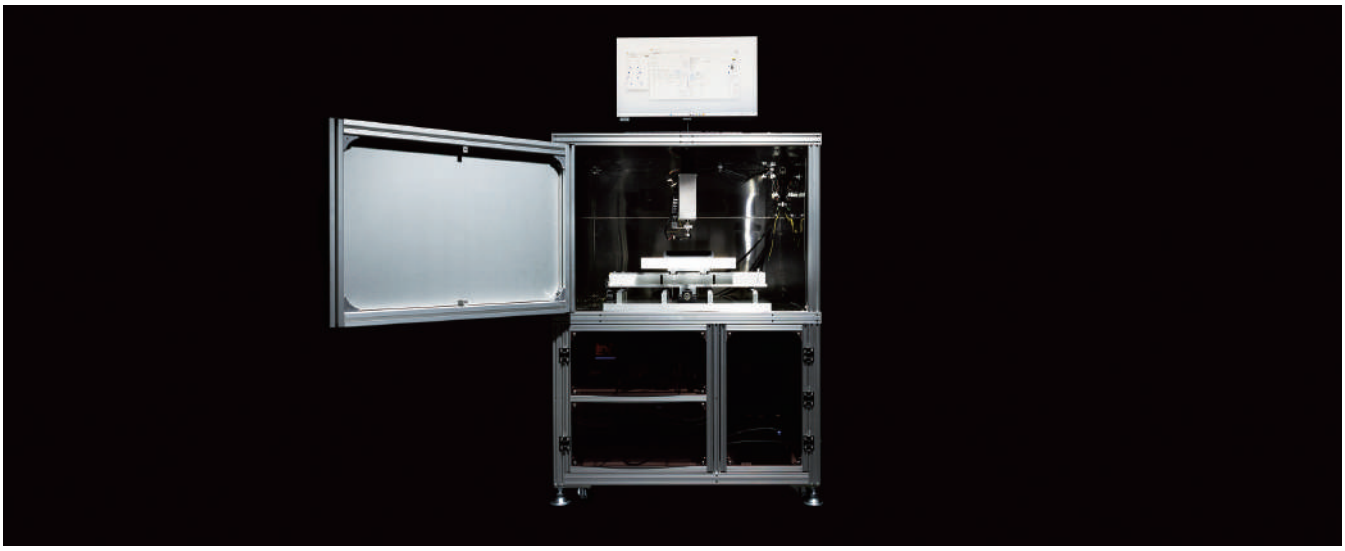
※Setting the threshold for latent defects (e.g., index of 4 or higher)

Product Specifications

Scaleable and Customizable from R&D to Mass Production

Versatile Testing Options: Failure Analysis, Sampling,
and Inline Full Inspection

Example: Failure Analysis & Sample Testing



Example: Inline Full Inspection

Frequently Asked Questions

Technology

Q. What defects can this sensor detect?

A. Our system detects localized current concentrations caused by contamination, lithium plating, or separator degradation.
Even batteries that pass conventional aging tests can exhibit localized current concentration when inspected with our system, which is linked to accelerated cycle degradation.
This system helps reduce fire risk and can detect defects as small as 0.1mV or less.

Measurement Process

Q. Are measurements conducted while charging or discharging?

A. The system performs measurements while applying an AC signal, ensuring that the SOC remains in a stable, near-constant state

Q. What is the detection accuracy?

A. It can detect micro short circuits as small as a few micrometers, and even smaller if current localization is present.

Q. How long does it take to inspect a non-defective battery?

A. Depending on battery size, thickness, and defect severity, inspections take from several hours to several tens of hours.

Q. Can All-Solid-State Battery(ASSB) be measured?

A. Yes.

System Integration

Q. Which processes can this system be integrated into?

A. This is the world' s first technology that can replace aging tests and can be used for shipment inspection, in-process inspection, inline inspection, R&D, and failure analysis.

Q. What is the equipment size?

A. ● **Single-unit model (1 sample)**
With door clearance : W910×D910×H1,260㎜

● **Multi-unit model (multiple samples)**
Customizable

Measurement Condition

Q. How many batteries can be measured simultaneously in inline inspection?

A. The system can be scaled up to measure multiple batteries simultaneously. For good batteries (at the 0.1mV or less level), measurement typically takes about one day, while defective batteries can be measured more quickly.